SNOQUALMIE RIVER BASIN CLASS II INSPECTIONS AT NORTH BEND, SNOQUALMIE, AND DUVALL WASTEWATER TREATMENT PLANTS

by
Tapas Das
December 1992

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Watershed Assessments Section
Olympia, Washington 98504-7710

Water Body Nos. WA-07-1100, WA-07-1100, WA-07-1060
(Segment No. 03-07-13)

ABSTRACT

Class II inspections were conducted at three municipal wastewater treatment plants in the Snoqualmie River Basin on September 24-25, 1991. North Bend and Duvall employ oxidation ditches, while Snoqualmie uses aerated lagoons. All plants were operating well at the time of inspection and met effluent discharge limitations. Snoqualmie and Duvall had potential problems with sampling and lab procedures. Snoqualmie effluent had high chlorine residuals. Other assorted recommendations are included in the report. A concurrent total maximum daily load (TMDL) study by EILS is also progressing in the Snoqualmie River Basin.

INTRODUCTION

Class II inspections were conducted at three municipal wastewater treatment plants (WWTPs): North Bend (NPDES Permit No. WA-002935-1); Snoqualmie (NPDES Permit No. WA-002240-3); and Duvall (NPDES Permit No. 002951-3) during September 24-25, 1991. Conducting the inspections were Tapas Das and Elissa Ostergaard of the Environmental Investigations and Laboratory Services (EILS) Program's Watershed Assessments Section. The operator provided assistance at each of the WWTPs: Larry Willett at North Bend, Dean Collins at Snoqualmie, and John Light at Duvall. A concurrent total maximum daily load (TMDL) study by EILS (Joy, in preparation) is also progressing in the Snoqualmie River Basin. Data from these inspections will contribute to the study. Figure 1 is a map of the basin showing the location of all three wastewater treatment plants.

Objectives of the inspections included:

1. verify compliance with NPDES permit limits;
2. determine loadings and removal efficiencies at the Snoqualmie WWTP;
3. provide effluent data (including metals) to support the river TMDL assessment; and
4. evaluate permittee's self-monitoring by reviewing sampling and flow measurement procedures, and by using sample splits.

The North Bend WWTP uses the extended aeration process with an oxidation ditch and two secondary clarifiers operated in parallel (Figure 2). Both secondary clarifiers were operating during the inspection. Flow measurement at the plant includes an in-line influent flow meter and an effluent Parshall flume. Sampling locations are shown in Figure 2.

The Snoqualmie WWTP is an aerated lagoon type secondary facility (Figure 3). Treatment units include two aerated lagoon cells in series and chlorination. Chlorine contact time is provided in the underground line between the chlorination building and the effluent weir. Sampling locations are shown in Figure 3.

The Duvall WWTP uses an aeration process with two oxidation ditches and two secondary clarifiers (Figure 4). Both oxidation ditches and both secondary clarifiers were operating during the inspection. Flow was measured at an effluent Parshall flume. The sampling location is shown in Figure 4.

METHODS

Grab and composite samples of effluent wastewater were collected at all three plants. Composite samples of influent wastewater were collected at the Snoqualmie WWTP to enable loadings and removal efficiencies to be calculated. Ecology's ISCO® composite samplers were installed at approximately the same locations as the dischargers' samplers except at North Bend. The North Bend effluent composite sampler was installed prechlorination--between the secondary clarifier and Parshall flume (Figure 2). All compositors were set for time proportional collection of 320 mL of sample every 30 minutes.

Ecology composite samplers were cleaned for priority pollutant metal sampling prior to the inspection. The protocol for cleaning equipment used in priority pollutant sampling is as follows:

1. Wash with laboratory phosphate-free detergent.
2. Rinse several times with tap water.
3. Rinse with 10% nitric acid solution.
4. Rinse three times with deionized water.
5. Allow to dry and seal with aluminum foil.

Composite samples were split at North Bend, Snoqualmie, and Duvall for comparative analyses. Effluent samples were split two ways (*i.e.*, Ecology along with the three WWTP labs each analyzed samples collected by both parties). All samples for analysis by Ecology were placed on ice until delivery to the Ecology Manchester Laboratory.

Because ultimate biochemical oxygen (BOD_u) demand values and appropriate kinetic descriptions were needed for water quality modeling studies of the river, a 60-day BOD (BOD_{60}) analysis was requested in addition to the traditional 5-day BOD (BOD_5) on each effluent composite sample collected by Ecology. An explanation of the protocol for this new parameter can be found in Whittemore (1991).

Parshall flumes were inspected for correct installation and critical dimensions. Due to unsafe access to the effluent weir at Snoqualmie, instantaneous flow verification and correct installation were not checked. However, instantaneous flows at the Snoqualmie influent flume as well as the North Bend and Duvall effluent flumes were determined by measuring depth of flow through the device and reading resultant flows from tables (ISCO, 1985). Comparisons were made to instantaneous readings on the plant flow recorders at all three WWTPs. Twenty-four-hour flows were also recorded from totalizers.

A summary of the analytical methods and laboratories conducting the analyses is given in Table 1. Laboratory quality assurance and quality control (QA/QC) methods are described by Huntamer and Hyre (1991) and Kirchmer (1988). Recommended holding times were met for all analyses performed. All initial and continuing calibration verification standards for metals analysis (by total recoverable method) were within the control limit of $\pm 10\%$. The method blanks associated with these samples showed trace levels of copper. Samples containing copper at levels within 10 times the level found in the blank are qualified with "B" indicating possible blank contamination (McIntosh, 1991). Spiked sample and duplicate spiked sample analyses were performed on sample numbers 398285 and 398296. The Relative Percent Difference (RPD) for all parameters was within the $\pm 20\%$ window for duplicate analysis, except for copper and zinc. Consequently, the copper and zinc values were qualified with "J" for poor precision (McIntosh, 1991).

RESULTS AND DISCUSSION

North Bend WWTP

Measurements taken of the critical dimensions of the 6-inch Parshall flume showed it was correctly installed and calibrated. Comparison of Ecology's instantaneous flow measurement to the WWTP effluent flowmeter reading was reasonably good (within 5%). The totalizer readings for a 24-hour time period (September 24-25) indicated a flow of 0.22 MGD; this flow was used to calculate effluent mass loadings for comparison to permit limits.

Conventional pollutant data collected during the inspection are tabulated in Table 2. The plant performed well during the inspection. BOD_5 and TSS results indicated a well-treated effluent. Fecal coliform counts were well within the NPDES permit limit. The BOD_{60} result turned out to be 12 mg/L, yielding an average value for the reaction-rate constant of 0.05 per day.

A comparison of effluent parameters to NPDES permit limits is presented in Table 3. The effluent met permit limits for BOD_5, TSS, fecal coliform, and pH at the time of inspection.

Table 4 compares results between North Bend and Ecology samples and labs. The BOD_5, TSS, and fecal coliform data show good agreement.

A listing of metals found in the effluent is presented in Table 5. Arsenic, cadmium, copper, lead, and zinc were detected; however, none of these concentrations exceeded acute or chronic water quality criteria (EPA, 1986).

Snoqualmie WWTP

Measurements taken of the critical dimensions of the influent 3-inch Parshall flume showed it was correctly installed and calibrated. The influent totalizer reading for a 24-hour time period (September 24-25) was 0.16 MGD. The effluent totalizer reading for the same 24-hour time period indicated a flow of 0.13 MGD; this latter flow was used to calculate the mass effluent loadings for comparison of permit limits. Ecology's instantaneous flow measurements to WWTP influent flow readings were good (within seven percent). The daily average flow rates at influent and effluent indicate that 0.03 million gallons (23%) of wastewaters are potentially lost by evaporation and percolation associated with the two lagoons.

Conventional pollutant data collected during the inspection are summarized in Table 6. The plant performed well during the inspection. Low ammonia and nitrate+nitrite nitrogen (NO_3+NO_2-N) in effluent indicated nitrification and denitrification were taking place in the lagoons. BOD_5 and TSS results indicated a well-treated effluent. The 60-day BOD result yielded 83 mg/L, yielding an average value for the reaction-rate constant (k) of 0.064 per day. For polluted water and wastewater, a typical value of k is 0.23 per day at 20°C. The value of k varies significantly, however, with the type of waste. The range may be from 0.05 to 0.3 per day. For the same ultimate BOD, the oxygen uptake will vary with time and with different k (Metcalf & Eddy, 1991). A significant drop in total phosphorus (74% based on Ecology composite samples) is attributable to sedimentation of wastewater solids and algae, a sign of adequate detention time in the lagoons.

A comparison of effluent parameters to NPDES permit limits is presented in Table 7. The effluent met permit limits for BOD_5, TSS, fecal coliform, and pH.

Table 7 shows BOD_5 and TSS loadings to the plant and the removal efficiencies. Currently, there is no design criterion for TSS loading contained in the permit. The permit also specifies that when the actual flow or waste load reaches 85% of design criteria, the permittee shall

submit to the department a plan and schedule for continuing to maintain adequate capacity. Table 7 indicates BOD_5 loading exceeded the 85% design criterion. However, plant flow was only 50% of the design criterion during the inspection.

The removal efficiencies for BOD_5 and TSS are 92% and 91%, respectively, well above the 85% requirement. Flow to the plant was well within the design criterion.

Table 4 compares results between the Snoqualmie and Ecology samples and labs. Results from samples collected by two different compositors (Ecology and Snoqualmie) but analyzed at the same lab (Snoqualmie) address the issue of sample representativeness. For the example presented, BOD_5 data were 19 versus 13 mg/L; TSS data were 33 versus 20 mg/L. These results indicate that samples appear to be not well representative. The Ecology and Snoqualmie (SQ) influent composite samplers' tubing and strainers accumulated some dirt and pieces of rag which probably contributed to this problem. Results from samples collected by the same compositor (Snoqualmie) but analyzed at two different labs address the issue of laboratory performance. For the example presented, BOD_5 data were 25 versus 13 mg/L; TSS data were 54 versus 20 mg/L. Both TSS and BOD_5 data reveal a potential problem with laboratory performance.

A listing of effluent metal analysis is presented in Table 5. Copper, lead, silver, and zinc were detected; however, only the silver concentration (flagged with "P") appeared to exceed the chronic freshwater quality criterion (EPA, 1986). Plant effluent had high chlorine residuals. An optimum total chlorine residual of 0.2-0.3 mg/L can be maintained while still keeping fecal coliform counts under control. High chlorine residuals are an unnecessary cost and can be a source of toxicity.

Duvall WWTP

Measurements taken of the critical dimensions of the 6-inch Parshall flume showed it was correctly installed and calibrated. Comparison of Ecology's instantaneous flow measurement to the WWTP effluent flow meter reading was reasonably good (within 8%). The effluent totalizer reading for a 24-hour time period (9/24-9/25) indicated 0.17 MGD; this flow was used to calculate effluent mass loadings for comparison to permit limits.

Conventional pollutant data collected during the inspection are tabulated in Table 8. The plant performed well during the inspection. BOD_5 and TSS results indicated a well-treated effluent. The 60-day BOD result was 82 mg/L, yielding an average value for the reaction rate constant (k) of 0.064 per day which is a typical value for wastewater (Metcalf & Eddy, 1991).

A comparison of effluent parameters to NPDES permit limits is presented in Table 9. The effluent easily met permit limits for BOD_5, TSS, fecal coliform, and pH. Incidentally, it appears that the weekly limit for fecal coliform specified in the permit is incorrect (100 instead of 400).

The effluent total ammonia (as nitrogen) concentration (10.2 mg/L, at pH=7.1 S.U. and temp.=18.9°C) was less than the acute freshwater quality criterion (15.6 mg/L), but exceeded the chronic freshwater quality criterion (1.2 mg/L) (EPA, 1986). Concern over this toxicity would be minimized by a dilution factor of 9:1 at the edge of the chronic mixing zone.

Table 4 compares results between Duvall and Ecology samples and labs. The BOD_5 and fecal coliform results generally indicate a close agreement, however, the difference in results for TSS between Duvall and Ecology labs was consistent and therefore noteworthy. No definite conclusions on laboratory performance can be drawn while the readings are this low and the data are so limited. In addition to two-way splits, a performance evaluation (PE) sample should be analyzed as part of the next inspection.

A listing of priority pollutant metal analyses is presented in Table 5. Cadmium, copper, and zinc were detected; however, only the cadmium concentration (flagged with "JNP") appeared to exceed the chronic freshwater quality criterion (EPA, 1986).

CONCLUSIONS AND RECOMMENDATIONS

North Bend WWTP

1. The plant was operating well at the time of the inspection and met applicable effluent limitations. The plant site and equipment appeared to be well maintained.

2. A comparison of split sample results showed good agreement.

3. Field data indicated that the North Bend effluent composite sample was higher than the recommended 4°C. The plant's effluent sample cooler should be inspected and repaired as necessary to provide better sample cooling.

Snoqualmie WWTP

1. The plant performed well during the inspection, and the plant site appeared to be adequately maintained. Plant effluent conformed to permit limitations.

2. The plant BOD_5 loading exceeded 85% of its design criterion at the time of inspection. The permit manager should evaluate whether there is a need to begin planning for an upgrade of the plant to meet present and future demands.

3. The influent composite sampler tubing and strainer accumulated some dirt and pieces of rag. The influent Parshall flume and its accessories should be cleaned more frequently.

4. Field data indicated that the Snoqualmie effluent composite sample temperature was much higher than the recommended 4°C. The plant's effluent sample cooler should be inspected and repaired as necessary to provide better sample cooling.

5. A comparison of split sample results for BOD_5 and TSS showed a disparity in the areas of sample representativeness and laboratory performance. To help resolve these issues, performance evaluation (PE) samples should be analyzed in the future inspection.

6. Effluent total chlorine residuals were relatively high (2.0 mg/L), while fecal coliform count was low (#3/100 mL). Snoqualmie's chlorination system and method should be inspected and corrected as necessary.

Duvall WWTP

1. The plant was performing well at the time of the inspection, and the facility appeared to be properly maintained. Effluent quantity and quality complied with permit limitations.

2. Effluent ammonia exceeded the chronic freshwater quality criterion. The permit manager should evaluate if mixing zone dilution ratios dictate the need for a water-quality-based permit limit.

3. A comparison of split sample results showed good agreement except for TSS. In addition to two-way splits, a performance evaluation (PE) sample should be analyzed in the future inspection.

4. Field data indicated that the plant's effluent sample temperature was much higher than the recommended 4°C. The plant's sample cooler should be inspected and repaired as necessary to provide better sample cooling.

REFERENCES

APHA-AWWA-WPCF, 1989. Standard Methods for the Examination of Water and Wastewater. 17th ed. American Public Health Association, Washington D.C.

EPA, 1983. Methods for Chemical Analyses of Water and Waste. EPA-600/4-79-020 (Rev. March, 1983), Washington D.C.

------, 1986. Quality Criteria for Water. EPA 440/5-86-001.

Huntamer, D. and Hyre, J., 1991. Ecology Laboratory User's Manual. Washington State Department of Ecology, July 1991, Manchester, WA.

ISCO, 1985. Open Channel Flow Measurement Handbook. Second Edition, ISCO, Inc. Environmental Division, Lincoln, NE.

Joy, J., 1992. Low Flow Total Maximum Daily Loading Study at the Snoqualmie River Basin. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA. (in progress).

Kirchmer, C., 1988. Quality Assurance Manual. Manchester Laboratory, Washington State Department of Ecology, Manchester, WA.

McIntosh, M., 1991. The Snoqualmie River Basin TMDL Study, Memorandum to T. Das and J. Joy, November 5, 1992. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA.

Metcalf and Eddy, Inc., 1991. Wastewater Engineering: Collection, Treatment, & Disposal. 3rd ed., New York, pp. 75.

Valderrama, J.C., 1981. The Simultaneous Analysis of Total Nitrogen and Total Phosphorus in Natural Waters. Marine Chemistry 10:109-122.

Whittemore, R., 1991. Ultimate Biochemical Oxygen Demand. Regional Manager, National Council of the Paper Industry for Air and Stream Improvement, Inc., Department of Civil Engineering, Tufts University, Medford, MA.

TABLES AND FIGURES

Table 1. Chemical Analytical Methods and Laboratories - Snoqualmie River Basin Class II Inspections, 9/91.

Parameter	Method	Lab used
Turbidity	EPA, 1983: 180.1	Ecology; Manchester, WA
Chloride	EPA, 1983: 330.0	Ecology; Manchester, WA
Hardness	EPA, 1983: 130.2	Ecology; Manchester, WA
SOLIDS4		
TS	EPA, 1983: 160.3	Ecology; Manchester, WA
TNVS	EPA, 1983: 106.4	Ecology; Manchester, WA
TSS	EPA, 1983: 160.2	Ecology; Manchester, WA
TNVSS	EPA, 1983: 106.4	Ecology; Manchester, WA
BOD5	EPA, 1983: 405.1	Ecology; Manchester, WA
BOD60	Whittemore, 1991	Ecology; Manchester, WA
TOC (water)	EPA, 1983: 415.2	Ecology; Manchester, WA
NUTRIENTS		
NH3-N	EPA, 1983: 350.1	Ecology; Manchester, WA
NO2+NO3-N	EPA, 1983: 353.2	Ecology; Manchester, WA
NO2-N	EPA, 1983: 353.2	Ecology; Manchester, WA
NO3-N	EPA, 1983: 352.2	Ecology; Manchester, WA
T-phosphorus	EPA, 1983: 365.1	Ecology; Manchester, WA
O-phosphate	EPA, 1983: 365.3	Ecology; Manchester, WA
T-persulfate nitrogen	Valderrama, 1981	Ecology; Manchester, WA
Fecal Coliform MF	APHA, 1989:9222D	Ecology; Manchester, WA
METALS		
PP metal (water)	EPA, 1983: 200	Sound Analytical Services, Inc; Tacoma, WA

TABLE 2. RESULTS OF GENERAL CHEMISTRY - CITY OF NORTH BEND WWTP, 9/91.

Location:	EFF-E	EFF-NB	EFF-G1	EFF-G2	BLANK
Type:	comp	comp	grab	grab	field
Date:	9/24-25	9/24-25	9/24	9/25	9/24
Time:	0830-0830	0830-0830	0855	0840	1630
Lab Log#3982:	-85	-86	-87	-88	-89
GENERAL CHEMISTRY					
Turbidity, NTU	2.8				
Chloride, mg/L	25.2				
Hardness, mg/L CaCO3	53.2				
TSS, mg/L	3	3			
BOD5, mg/L	3	6			
BOD60, mg/L	12*				
TOC, mg/L	10.2				
NH3-N, mg/L	0.02		0.04		
NO2-NO3, mg/L	5.9		4.77		
T-Phosphorus, mg/L	4.2	4.23	4.12		
O-Phosphate, mg/L	3.9	3.81	3.47		<0.01
T-Persulfate Nitrogen, mg/L	6.8		5.74		
Fecal Coliform (MF), #/100 mL			9	7	
FIELD MEASUREMENTS					
Flow, MGD	0.22				
Temperature, °C	5.1**	8.8**	15.9	16.1	
pH, S.U.	6.8	6.7	7.0	6.5	
Conductivity, μmhos/cm	319	272	310	299	
Dissolved Oxygen, mg/L			5.9	6.7	
Chlorine (total residual), mg/L			0.2	0.4	

Eff - Effluent, E - Ecology sample, NB - North Bend sample

* - Based on an average value of reaction-rate constant (k) equal to 0.05 per day.

** - Iced composite samples.

Table 3. Comparison of Inspection Results to NPDES Permit Limits - North Bend WWTP, 9/91.

Parameter	NPDES Permit Limits		Field Data	
	Monthly Average	Weekly Average	Ecology Composite	Inspection Results
Effluent BOD5				
(mg/L)	30*	45	3	
(lbs/day)	100	150		6
Effluent TSS				
(mg/L)	30*	45	3	
(lbs/day)	100	150		6
Fecal Coliform^^				
(#/100 mL)	200^	400^	9;7	
pH^^ (S.U.)	6.0≤pH≤9.0		6.5≤pH≤7.0	
Flow (MGD)				0.22

* or 15% of the influent concentration, whichever is more stringent.

^ The average for fecal coliform bacteria is based on the geometric mean of the samples taken.

^^ Grab sample analyses.

Table 4. Comparison of Sample Splits – Snoqualmie River Basin Class II Inspections, 9/91.

Sample	Sampler	Laboratory	BOD5 (mg/L)	TSS (mg/L)	F-Coliform (#/100 mL)
NORTH BEND					
Eff-E	Ecology	Ecology	3	3	9;7
(398285)		North Bend	4	8	
Eff-NB	North Bend	Ecology	6	3	
(398286)		North Bend	4	6	6;6
SNOQUALMIE					
Eff-E	Ecology	Ecology	24	37	<3;3
(398291)		Snoqualmie	19	33	
Eff-SQ	Snoqualmie	Ecology	25	54	
(398292)		Snoqualmie	13	20	7;3
DUVALL					
Eff-E	Ecology	Ecology	9	5	3;10
(398296)		Duvall	11	10	
Eff-DV	Duvall	Ecology	6	5	
(398297)		Duvall	9	10	4;12

Table 5. Results of Effluent Metals Analyses - Snoqualmie River Basin Class II Inspections, 9/91.

Field Station:	Eff-E/NB	Eff-E/SQ	Eff-E/DV	Water Quality Criteria* (µg/L)	
Type:	comp	comp	comp	Freshwater	
Date:	9/24-25	9/24-25	9/24-25		
Time:	0830-0830	1100-1100	1340-1340		
Lab sample#:	398285	398291	398296	Acute	Chronic
Metals tot rec (µg/L)					
Antimony	30 U	30.0 U	30.0 U	-	-
Arsenic	5.3	1.5 U	1.5 U	-	-
Beryllium	1.0 U	1.0 U	1.0 U	-	-
Cadmium	0.14 P	0.1 U	2.1 JNP	3.9	1.1
Chromium	5.0 U	5.0 U	5.0 U	-	-
Copper	10.0 BJN	8.4 BJN	5.0 BJNP	18	12
Lead	1.2 P	2.7 P	1.0 U	82	3.2
Mercury	0.2 U	0.2 U	0.2 U	2.4	0.012
Nickel	10.0 U	10.0 U	10.0 U	1400	160
Selenium	2.0 U	2.0 U	2.0 U	260	35
Silver	3.0 U	0.55 P	3.0 U	4.1	0.12
Thallium	2.5 U	2.5 U	2.5 U	-	-
Zinc	43.6 JN	11.0 JNP	36.9 JN	120	110

Eff - Effluent, E - Ecology sample, NB - North Bend WWTP, SQ - Snoqualmie WWTP, DV - Duvall WWT

B - Analyte was also found in the analytical method blank indicating the sample may have been contaminated.

J - Indicates an estimated value when result is less than specified detection limit.

N - The spike sample recovery is not within control limits.

P - The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

U - The analyte was not detected at or above the reported result.

* - EPA, 1986 (based on hardness of 100 mg/L as CaCO3).

Shaded area denotes metal detected.

TABLE 6. RESULTS OF GENERAL CHEMISTRY - CITY OF SNOQUALMIE WWTP, 9/91.

Location:	INF-E	EFF-E	EFF-SQ	EFF-G1	EFF-G2
Type:	comp	comp	comp	grab	grab
Date:	9/24-25	9/24-25	9/24-25	9/24	9/25
Time:	1050-1050	1100-1100	1100-1100	1040	1035
Lab Log#3982:	-90	-91	-92	-93	-94
GENERAL CHEMISTRY					
Turbidity, NTU		15			
Chloride, mg/L		31.7			
Hardness, mg/L CaCO3		45.2			
TSS, mg/L	424	37	54		
BOD5, mg/L	288	24	25		
BOD60, mg/L		83*			
TOC, mg/L		26.5			
NH3-N, mg/L		0.54		0.70	
NO2-NO3, mg/L		0.45		0.40	
T-Phosphorus, mg/L	6.72	1.72	2.10	1.96	
O-Phosphate, mg/L		1.16	1.27	1.20	
T-Persulfate Nitrogen, mg/L		4.07		4.54	
Fecal Coliform (MF), #/100 mL				<3	3
FIELD MEASUREMENTS					
Flow, MGD	0.16	0.13			
Temperature, °C	5.9**	6.5**	17.1	16.8	17.3
pH, S.U.	7.3	6.9	7.0	7.2	6.6
Conductivity, μmhos/cm	495	323	321	308	318
Dissolved Oxygen, mg/L				7.6	6.7
Chlorine (total residual), mg/L				2.0	2.0

Inf - Influent, Eff - Effluent, E - Ecology sample, SQ - Snoqualmie sample

* - Based on an average value of reaction-rate constant (k) = 0.064 /day.

** - Iced composite samples.

Table 7. Comparison of Inspection Results to NPDES Permit Limits - Snoqualmie WWTP, 9/91.

Parameter	NPDES Permit Limits		Ecology	Plant Loading			
	Monthly Average	Weekly Average	Composite	Design Criteria	85% of DC	Inspection Results	% of DC
Influent BOD5							
(mg/L)			288				
(lbs/day)				339	288	312	92
Effluent BOD5							
(mg/L)	30*	45	24				
(lbs/day)	51	76				26	
(% removal)	85					92	
Influent TSS							
(mg/L)			424				
(lbs/day)				-	-	473	-
Effluent TSS							
(mg/L)	75	110	37				
(lbs/day)	163	239				41	
(% removal)	85					91	
Fecal Coliform							
(#/100 mL)	200^	400^	<3;3				
pH (S.U.)	6.0≤pH≤9.0		6.6-7.2				
Flow (MGD)				0.26	0.22	0.13	50

* or 15% of the respective influent concentrations, whichever is more stringent.

^ The average for fecal coliform bacteria is based on the geometric mean of the samples taken.

TABLE 8. RESULTS OF GENERAL CHEMISTRY - CITY OF DUVALL WWTP, 9/91.

Location:	EFF-E	EFF-DV	EFF-G1	EFF-G2
Type:	comp	comp	grab	grab
Date:	9/24-25	9/24-25	9/24	9/25
Time:	1340-1340	1340-1340	1400	1330
Lab Log#3982:	-96	-97	-98	-99
GENERAL CHEMISTRY				
Turbidity, NTU	4.6			
Chloride, mg/L	34.7			
Hardness, mg/L CaCO3	32.6			
TSS, mg/L	5.0	5.0		
BOD5, mg/L	9.2	6.0		
BOD60, mg/L	82*			
TOC, mg/L	14.6			
NH3-N, mg/L	10.1		10.2	
NO2-NO3, mg/L	0.18		0.60	
T-Phosphorus, mg/L	5.43	5.36	5.16	
O-Phosphate, mg/L	4.29	4.33	4.08	
T-Persulfate Nitrogen, mg/L	13.2		13.2	
Fecal Coliform (MF), #/100 mL			3	10
FIELD MEASUREMENTS				
Flow, MGD	0.17			
Temperature, °C	7.2**	13.6**	18.9	19.8
pH, S.U.	7.0	7.0	7.1	6.8
Conductivity, μmhos/cm	488	475	462	463
Dissolved Oxygen, mg/L			6.7	6.0
Chlorine (total residual), mg/L			1.5	1.5

Eff - Effluent, E - Ecology sample, DV - Duvall sample

* - Based on an average value of reaction-rate constant (k) = 0.064 /day.

** - Iced composite samples.

Table 9. Comparison of Inspection Results to NPDES Permit Limits - Duvall WWTP, 9/91.

Parameter	NPDES Permit Limits		Field Data	
	Monthly Average	Weekly Average	Ecology Composite	Inspection Results
Effluent BOD5				
(mg/L)	30*	45	9.2	
(lbs/day)	50	75		13
Effluent TSS				
(mg/L)	30*	45	5.0	
(lbs/day)	50	75		7.1
Fecal Coliform^^				
(#/100 mL)	200^	100^	3;10	
pH^^ (S.U.)	6.0≤pH≤9.0		6.8≤pH≤7.1	
Flow (MGD)				0.17

* or 15% of the influent concentration, whichever is more stringent.

^ The average for fecal coliform bacteria is based on the geometric mean of the samples taken.

^^ Grab sample analyses.

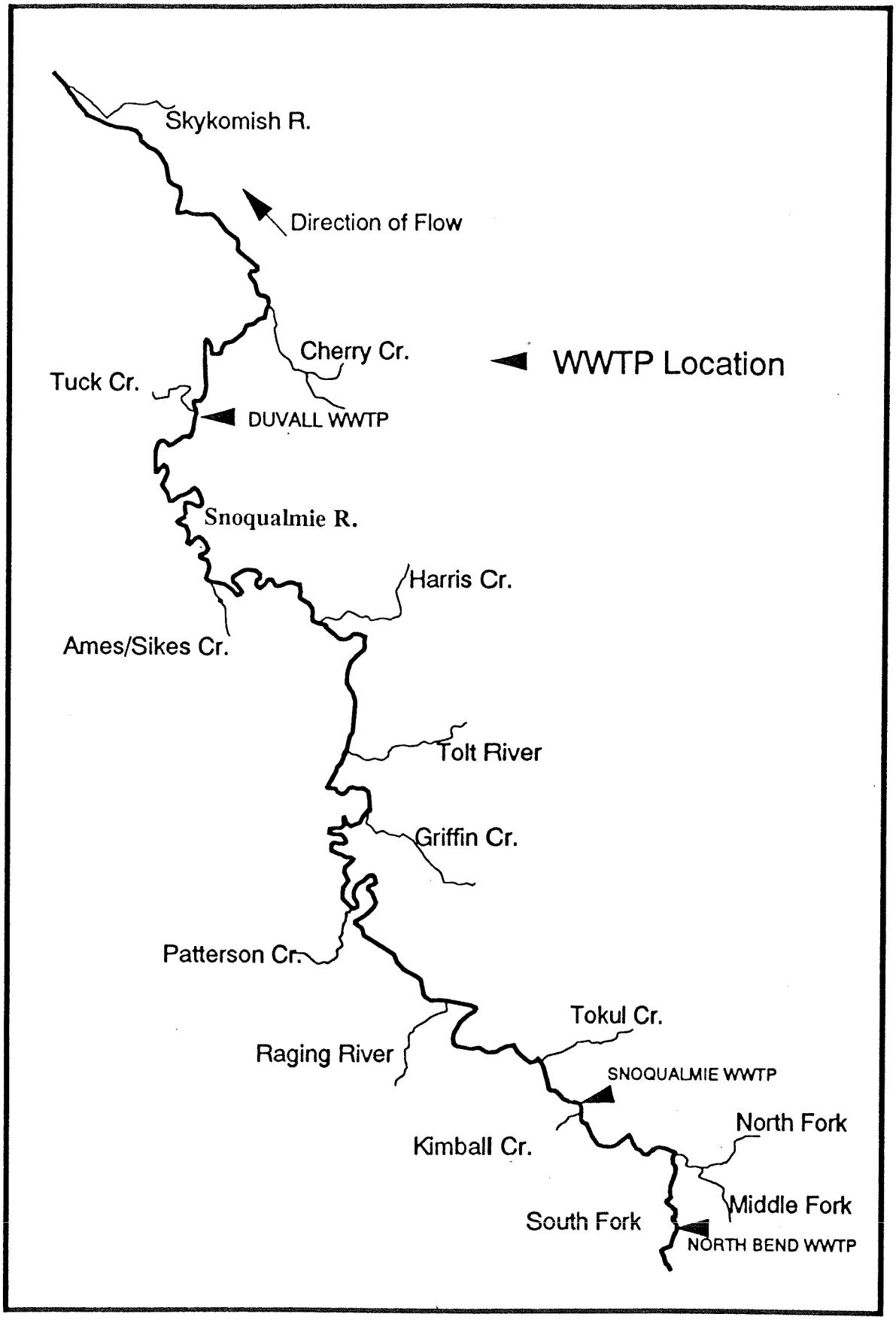

Figure 1. Location Map - Snoqualmie River Basin Class II Inspections, 9/91.

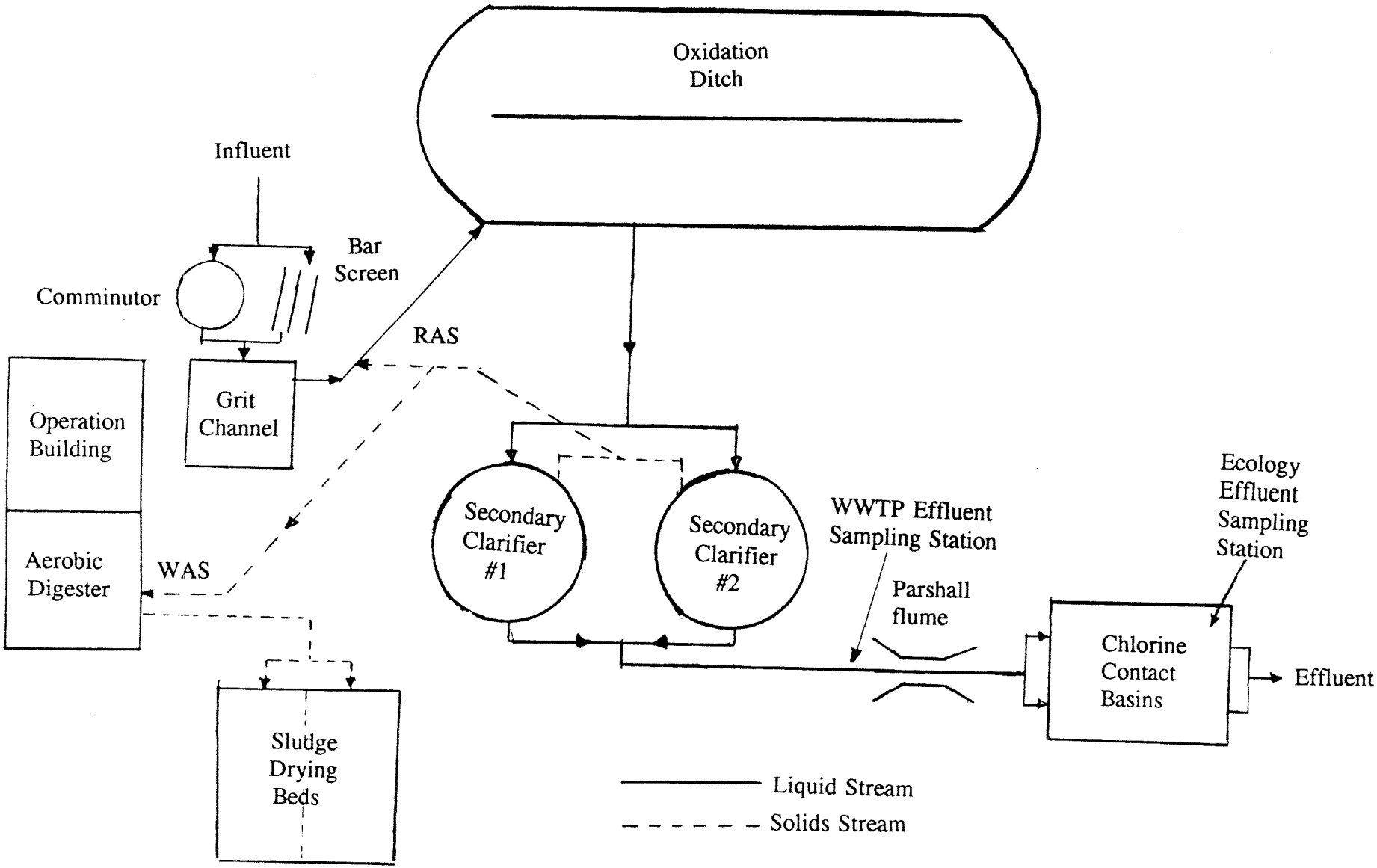

Figure 2. North Bend WWTP Schematic and Sample Sites - 9/91.

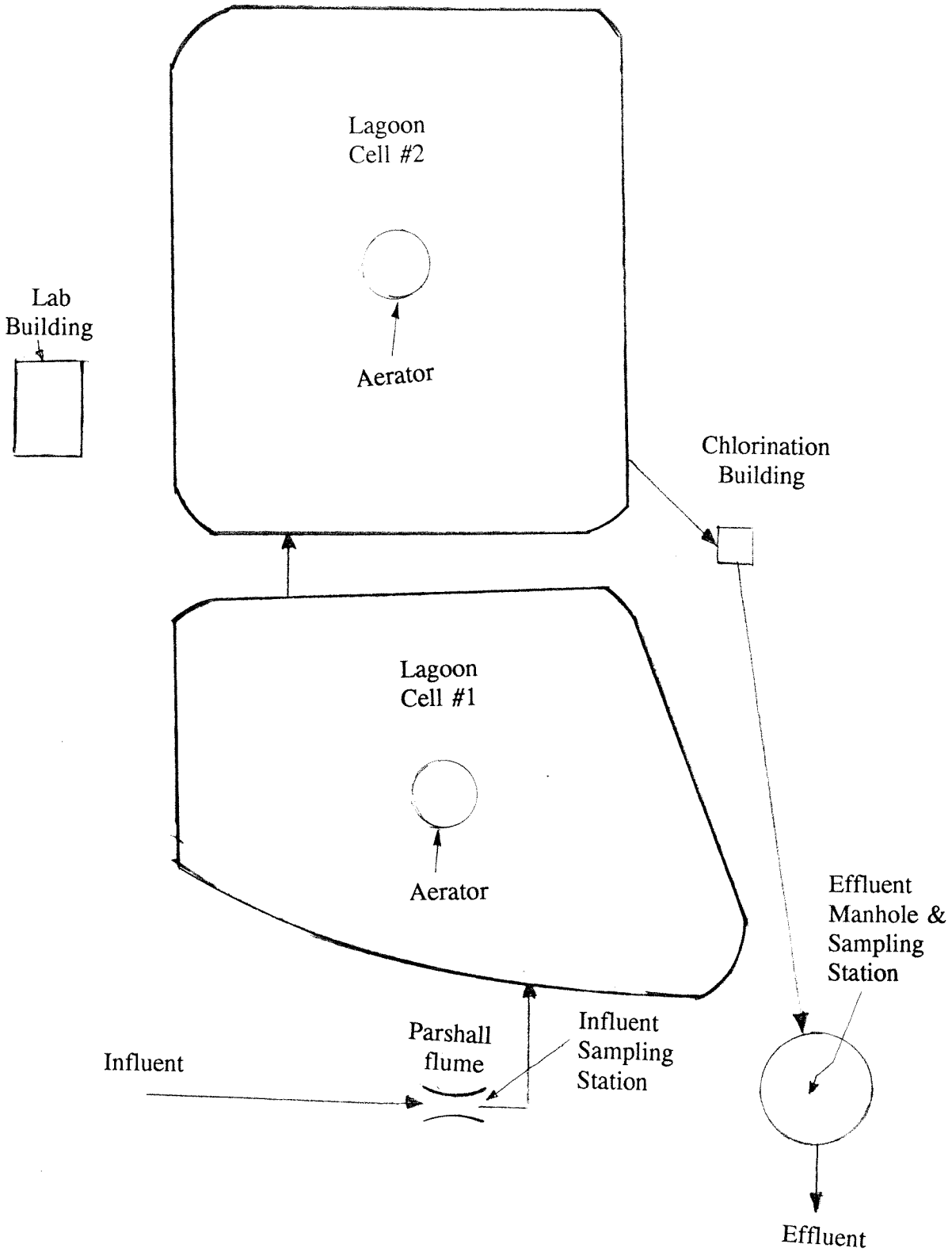

Figure 3. Snoqualmie WWTP Schematic and Sample Sites - 9/91.

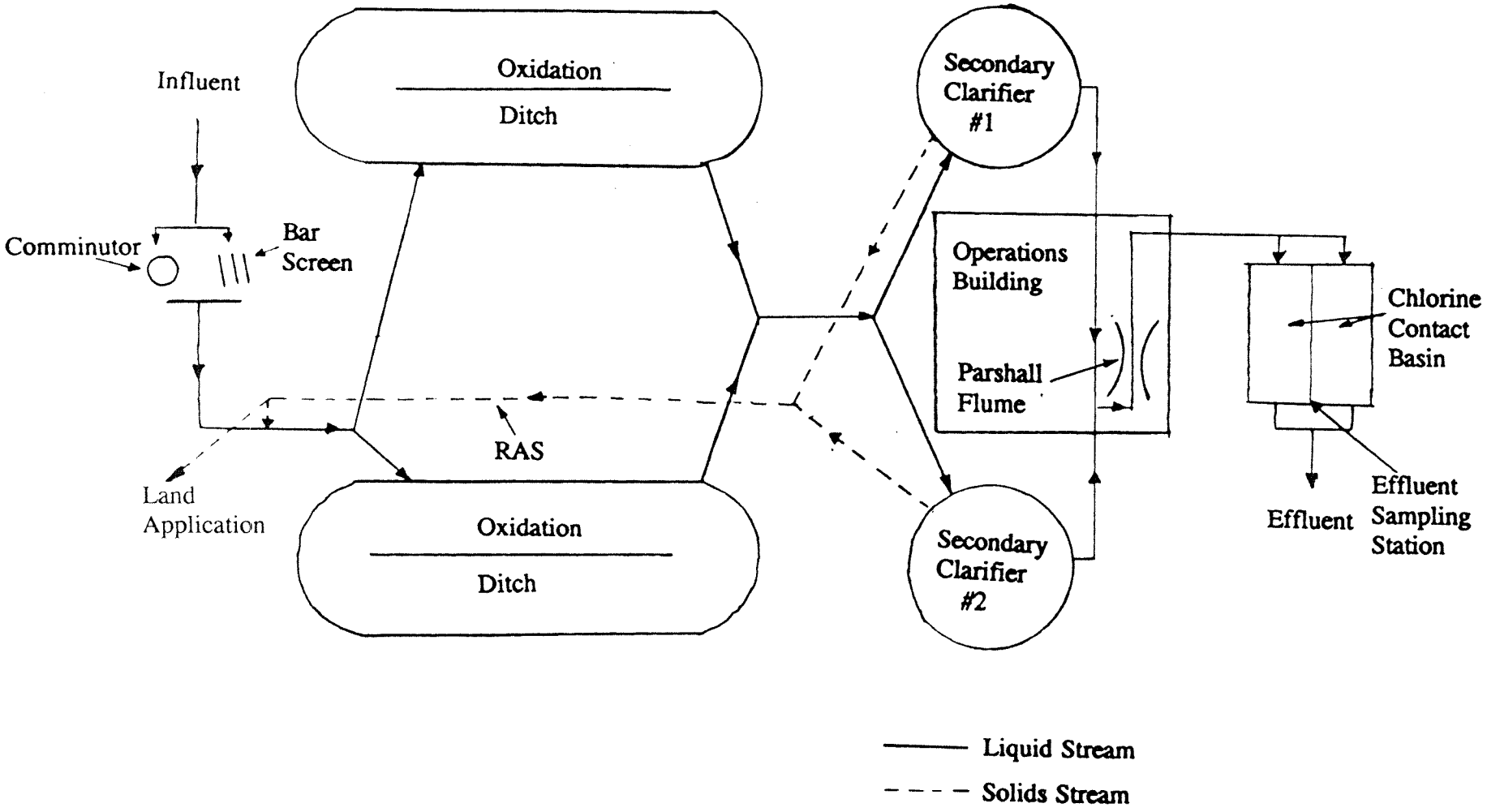

Figure 4. Plant Schematic and Sampling Location - Duvall WWTP, 9/91.